

## **TAMPER EVIDENT LOCKING ASSEMBLY**

### **CROSS REFERENCES TO RELATED APPLICATIONS**

[0001] This application claims the priority benefit of U.S. Provisional Patent Application No. 60/447,129 filed on February 13, 2003.

### **STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH**

[0002] Not Applicable.

### **BACKGROUND OF THE INVENTION**

[0003] The invention relates to locking devices and is directed more particularly to a destructible locking assembly for use in conjunction with utility meter ring, gas service valves, and similar devices.

[0004] To prevent tampering with utility meters, or the like, it is customary that a cover member, often of transparent glass, be placed over the face of the meter and secured to a meter box by a metal meter ring. The meter ring includes two flanges which extend outwardly from the ring substantially parallel to each other. Typically, the flanges are provided with holes enabling an operator to place a padlock through the holes for locking the flanges together to fix the ring to the meter, thereby locking in place the glass cover.

[0005] Unfortunately, those who are so inclined often are able to either secure a key appropriate for opening the lock, or obtain access to the meter by "picking" the lock. In

either case, the lock usually is returned to the closed condition, without any indication of tampering having taken place. The utility meter reader then has no way to tell that the meter reading has been altered. Accordingly, a locking device which could not be opened by a key and which would provide a readily visible sign of having been tampered with, would be beneficial to the utility industry.

[0006] One exemplary locking assembly that solves these problems is disclosed in U.S. Pat. No. 5,161,838, and is assigned to the assignee of the present invention. This locking assembly includes a housing member and a stud member for locking first and second members relative to each other. The housing member is adapted to receive the stud member extending through aligned openings formed in the first and second members. The housing member permanently retains the stud member in the housing to lock the first and second members together. The stud member includes a frangible portion that can be broken away from the stud member to unlock the first and second members relative to each other, and provide evidence that the locking assembly has been tampered with.

[0007] Although products incorporating the invention disclosed in U.S. Pat. No. 5,161,838 have been very successful in the marketplace, the housing and stud members are by design a single use assembly in order to provide evidence of tampering. Moreover, the product has typically been adapted for use with a conventional meter ring having radially extending flanges with holes defining axes extending tangential to the ring. As a result, The locking assembly extends tangential to the ring through the holes. The frangible portion of the stud can be difficult to break when oriented tangentially to the

ring. In addition, unscrupulous individuals can hide evidence of tampering the above locking assembly by rejoining the first and second members back together, such as by adhesives and the like.

## BRIEF SUMMARY OF THE INVENTION

[0008] The present invention provides a locking assembly adapted for locking first and second members together which solves the above problems. The assembly includes a housing member having an opening including an insertion end formed therein. A retention member is disposed in the opening. A stud member includes a head portion and a shank portion joined by a separable portion. The shank portion is received in the opening through the insertion end and engages the retention member to prevent removal of the shank portion from the opening through the insertion end. With the first and second members disposed between the housing member body portion and the stud member head portion, upon breaking of the separable portion, the head portion separates from the shank portion to allow separation of the first and second ends. In one embodiment the opening is a through hole having an insertion end and an exit end, and upon breaking the separable portion the shank portion passes out of the through hole through the exit end which allows the housing member to be reused. In another embodiment, a seal covers the head portion to provide a surface for identifying indicia and evidence of tampering. In yet another embodiment, the locking assembly includes a ring member that orients the housing member and stud member substantially parallel to a ring axis to present the head

portion for engagement by a user to break the separable portion and separate the head portion from the shank portion.

[0009] A general objective of the present invention is to provide a locking assembly that provides evidence of tampering. This objective is accomplished by providing a stud member formed from a shank portion and head portion joined by a separable portion, wherein upon breaking the separable portion the head portion separates from the shank portion to provide evidence of tampering.

[0010] Another objective of the present invention is to provide further evidence of tampering. This objective is accomplished by providing a seal over the head portion that that is deformable during an attempt to break the separable portion. The deformed seal provides evidence of tampering.

[0011] Yet another objective of the present invention is to provide a locking assembly having a reusable housing. This objective is accomplished by providing a through hole having an insertion end and an exit end in the housing member that receives the shank portion of the stud member through the insertion end, wherein upon separation the head portion from the shank portion, the shank portion passes through the exit end of the through hole which allows reuse of the housing member.

[0012] Still another objective of the present invention is to provide a front entry locking assembly for a meter. This objective is accomplished by providing a locking assembly with a ring member having legs with overlapping surfaces. Holes formed in the surfaces receive a housing member extending substantially parallel to an axis defined by the ring member

[0013] The foregoing and other objectives and advantages of the invention will appear from the following description. In the description, reference is made to the accompanying drawings which form a part hereof, and in which there is shown by way of illustration a preferred embodiment of the invention.

#### BRIEF DESCRIPTION OF THE DRAWINGS

- [0014] Fig. 1 is a perspective view of a utility meter with a cover locked by a locking assembly incorporating the present invention;
- [0015] Fig. 2 is a cross sectional view of the locking assembly of Fig. 1;
- [0016] Fig. 3 is an cross sectional, exploded view of the housing and stud members of Fig. 2;
- [0017] Fig. 4 is a plan view of the meter ring of Figs. 1;
- [0018] Fig. 5 is a front elevational view of the meter ring of Fig. 4;
- [0019] Fig. 6 is a plan view of the seal of Fig. 2;
- [0020] Fig. 7 is an alternative embodiment of the stud member for use in a locking assembly incorporating the present invention;
- [0021] Fig. 8 is another alternative embodiment of the stud member for use in a locking assembly incorporating the present invention;
- [0022] Fig. 9 a cross sectional view of an alternative embodiment of a locking assembly incorporating the present invention; and
- [0023] Fig. 10 is a cross sectional view of an alternative embodiment of a stud member for use in the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] As shown in Figs. 1 and 2, a locking assembly 10 locks a meter ring 12 wrapped around a meter cover 14. The meter ring 12 holds the cover 14 to a meter box 16 over a meter 18. Angles 20, 22 fixed to the meter ring 12 include alignable holes 24, 26 for receiving the locking assembly 10. The locking assembly 10 is oriented in the holes 24, 26 to allow engagement from the front of the meter box 16. Although the locking assembly 10 is shown locking a meter ring 12, the locking assembly 10 can be used independent of the meter ring 12 to lock other devices, such as valves, doors, and the like without departing from the scope of the invention.

[0025] Referring now to Figs. 1-3, the locking assembly 10 includes a housing member 28 engageable with a stud member 30 to lock the angles 20, 22 together, and prevent undetected removal of the meter ring 12 from around the meter cover 14. The housing member 28 has a body portion 32 including a flange portion 34. The body portion 32 is cylindrical having an axial through hole 36 therethrough defined by an inside wall 38 for receiving the stud member 30. The through hole 36 includes an insertion end 40 that receives the stud member 30 and an exit end 42 through which a shank portion 60 of the stud member 30 passes when unlocking the meter ring 12.

[0026] The stud member 30 is retained by a snap ring 44 received in a radially inwardly opening groove 46 formed in the inside wall 38. The radial groove 46 has a radially inwardly facing inclined wall 48 that defines a first diameter and a second diameter. The first diameter is on a side 50 of the radial groove 46 closer to the exit end 42 of the through hole 36. The second diameter is smaller than the first diameter, and is

on a side 52 of the radial groove 46 further from the exit end 42 of the through hole 36. Accordingly, when the snap ring 44 is urged in a direction away from the exit end 42 of the through hole 36 towards the insertion end 40, the snap ring 44 is urged radially inwardly toward the center of the through hole 36 by the radial groove inclined wall 48 to prevent removal of the stud member 30 through the insertion end 40.

[0027] The housing member 28 is fixed to one of the angles 22 by the flange portion 34 and a mounting ring 54. The flange portion 34 extends radially outwardly from the body portion 32 proximal the exit end 42 of the through hole 36. An upper surface 55 of the flange portion 34 engages a lower surface 56 of one of the angles 22 to prevent the housing member 28 from slipping completely through the hole 26 formed in the angle 22.

[0028] The mounting ring 54 is retained in a radially outwardly opening groove 58 formed in the body portion 32 between the flange portion 34 and the through hole insertion end 40. The angle 22 is sandwiched between the mounting ring 54 and flange portion 34 to secure the housing member 28 to the angle 22 and simplify locking the angles 20, 22 together. Of course, the housing member 28 can be secured to one of the angles 20, 22 using other methods, such as welding, threads, adhesives, and the like, without departing from the scope of the invention. Moreover, the housing member 28 is secured to the angles 20, 22 upon insertion of the stud member 30 in the through hole 36, thus securing the housing member 28 to one of the angles 20, 22 prior to locking the meter ring 12 is not required.

[0029] The stud member 30 is inserted into insertion end 40 of the through hole 36 formed through the housing member 28, and includes the shank portion 60 and a head

portion 62 joined by separable portion 64. The shank portion 60 is provided with at least one circumferential groove 66 adapted to receive the snap ring 44 disposed in the housing member body portion through hole 36.

[0030] The separable portion 64 is defined by a groove 68 formed at the juncture of the shank portion 60 and head portion 62, such that the head portion 62 can be broken away from the shank portion 60 to unlock the meter ring 12. The head portion 62 may be further provided with a recess 70 adapted to receive a pressure-applying tool for breaking the separable portion 64 of the stud member 30. Although the separable portion 64 is shown to be breakable with an axial force applied to the head portion 62, a separable portion that is breakable upon the application of other forces, such as torque, bending, shear, and the like, can be substituted without departing from the scope of the invention.

[0031] A seal 72 shown in Figs. 2, 3, and 6 is fixed over the head portion 62 which must be penetrated in order to break the separable portion 64 and separate the head portion 62 from the shank portion 60. The seal 72 is preferably formed from a non-resilient material, such as plastic, metal, and the like. Most preferably, the seal 72 is a clear acrylic. However, a colored, opaque, or non-clear seal can be provided without departing from the scope of the invention. Other materials that provide evidence of tampering, however, can be used, such as foil, paper, adhesives, wax, and the like without departing from the scope of the invention.

[0032] A tab 74 extending from the seal 72 can be provided having indicia formed thereon, such as a serial number, date, bar code, and other identifying information, to identify the meter to service persons and other personnel. Although a tab 74 having



indicia formed thereon is shown, a label having indicia thereon and sandwiched between the seal 72 and head portion 62 can be provided without departing from the scope of the invention. Moreover, identifying indicia can also be formed on the seal 72, such as shown in Fig. 6, without departing from the scope of the invention.

[0033] The seal 72 is secured over the head portion 62 by a seal tab retainer 76 received in a retaining ring 78. The seal 72 is sandwiched between the head portion 62 and the seal tab retainer 76 which is secured relative to the head portion 62 by the retaining ring 78. Although securing the seal 72 over the head portion 62 using a retaining ring 78 and seal tab retainer 76 is disclosed, other methods known in the art for securing seals to an object, such as by adhesive, thermal bonding, mechanical bonding, and the like, and additional novel methods described below, can be used without departing from the scope of the invention.

[0034] The retaining ring 78 is a cylindrical member encircling the head portion 62, and includes a cylindrical wall 80 having an inner surface 82 extending between upper and lower edges 84, 86. A lip 88 extending radially inwardly from the lower edge 86 engages a bottom surface 90 of the head portion 62 to prevent the retaining ring 78 from being pulled axially upwardly past the head portion 62. The inner surface 82 extends upwardly past the head portion 62, and engages the seal tab retainer 76 to secure the seal tab retainer 76 over the seal 72 and head portion 62. Preferably, a slot 92 is formed in the cylindrical wall 80, and the tab 74 extends through the slot 92 when the seal 72 is sandwiched between the seal tab retainer 76 and the head portion 62.

[0035] The seal tab retainer 76 is a cylindrical member defining a through hole 94, and has an outer surface 96 engaging the inner surface 82 of the retaining ring 78.

Preferably, the seal tab retainer 76 is press fit into engagement with the retaining ring inner surface 82 to sandwich the seal 72 between the seal tab retainer 76 and head portion 62, and prevent removal of the seal tab retainer 76 without leaving evidence of tampering. However, other methods can be used to secure the seal tab retainer in the retaining ring, such as adhesives, thermal bonding, mechanical bonding, and the like, without departing from the scope of the invention. Advantageously, the seal tab retainer through hole 94 provides access for the pressure applying tool to break the seal 72 and separable portion 64 when unlocking the meter ring 12.

[0036] In the embodiment shown in Figs. 1-5, the locking assembly 10 locks the meter ring 12 wrapped around the meter cover 14 to lock the cover 14 to the meter box 16 over the meter 18. The meter ring 12 defines an axis 98, and is provided with first and second ends 100, 102, with a first flange 104 extending from the first ring member end 100 and a second flange 106 extending radially from the second ring member end 102. The first and second flanges 104, 106 extend outwardly from the meter ring 12 and generally parallel to each other.

[0037] The first angle 20 is fixed to the first flange 104, and includes a first leg 108 and a second leg 110. The first leg 108 extends substantially parallel to the meter ring axis 98, and is fixed to the first flange 104 using methods known in the art, such as welding, an the like. The second leg 110 extends substantially perpendicular to the first leg 108, and passes over the second flange 106.

[0038] The second angle 22 is fixed to the second flange 106, and includes a first leg 112 and a second leg 114. The first leg 112 extends substantially parallel to the meter ring axis 98, and is fixed to the second flange 106 using methods known in the art, such as welding, an the like. The second leg 114 of the second angle 22 extends substantially perpendicular to the second angle first leg 112 below the second leg 110 of the first angle 20 in an overlapping relation.

[0039] The second legs 110, 114 of the first and second angles 20, 22 are, respectively, provided with the holes 24, 26 extending therethrough, the holes 24, 26 being readily alignable to receive the locking assembly. Preferably, the hole 24 formed in the second leg 110 of the first angle 20 is sized to receive a portion of the housing member 28 fixed in the hole 26 formed in the second leg 114 of the second angle 22. Advantageously, receiving a portion of the housing member 28 in the hole 24 formed in the second leg 110 of the first angle 20 allows a user to maintain the holes 24, 26 in an aligned relation as the stud member 30 is inserted into the housing member through hole 36.

[0040] Advantageously, the axes of the aligned holes 24, 26 are substantially parallel to the meter ring axis 98 to orient the locking assembly housing member 28 and stud member 30 substantially parallel with the meter ring axis 98. Orienting the stud member 30 substantially parallel to the meter ring axis 98 allows engagement of the separable portion 64 of the locking assembly 10 from a front direction (i.e. parallel to the ring member axis 98) which provides easy access for breaking the separable portion 64 and

removal of the stud member 30 from the housing member 28 disposed in the aligned holes 24, 26.

[0041] In the embodiment disclosed in Figs. 4 and 5, opposite corners 146, 148 of the distal end of the second leg 110, 114 of each angle 20, 22 is rounded. Rounding the corners 146, 148 exposes engagement surfaces 150, 152 for engagement by the user to separate the legs 110, 114, and disengage the housing member 28 from the hole 24 formed in the second leg 110 of the first angle 20 once the stud member 30 has been removed upon unlocking the locking assembly 10.

[0042] In operation, the housing member body portion 32 is inserted into the first aligned holes 24, 26 beginning with the hole 26 in the second angle 22, and the stud member shank portion 60 is inserted into the insertion end 40 of the housing member through hole 36 to sandwich the angles 20, 22 between the head portion 62 of the stud member 30 and the flange portion 34 of the housing member 28. The snap ring 44 partially enters the circumferential groove 66 to lock the stud member 30 to the housing member 28.

[0043] To part the housing and stud members 28, 30 destruction of the stud member 30 is required. To that end, a pressure-applying tool, such as disclosed in U.S. Pat. No. 5,161,835, can be used to break the separable portion 64 of the stud member 30. Of course, other tools, such as a screw driver, pliers, chisel, and the like can be used to separate the head portion 62 from the shank portion 60 depending upon the force necessary to break the separable portion 64. Breaking the separable portion 64 separates

the head portion 62 from the shank portion 60, and permits separation of the angles 20, 22, and thus the ring member flanges 104, 106.

[0044] Separation of the ring member flanges 104, 106 permits removal of the meter ring 12 and meter cover 14 which allows access to the meter 18. Accordingly, to gain access to the meter 18, the stud member 30 and seal 72 is deformed and, once deformed, such deformation is permanent and quite observable. Advantageously, by providing the housing member 28 with a through hole 36, upon breaking the separable portion 64, the shank portion 60 can slip through the exit end 42 of the through hole 36, and allow reuse of the housing member 28, and if the housing member 28 is fixed to the meter ring 12, either directly or via an angle 20, 22, the meter ring 12 can be reused. Moreover, the deformed seal 72 provides additional evidence of tampering that is difficult to disguise.

[0045] In yet another embodiment shown in Fig. 7, the seal 72 is retained by a seal tab retainer in the form of a tubular band 130. An upper edge 132 of the tubular band 130 is crimped over edges of the seal 72, and a lower edge 134 of the tubular band 130 is crimped beneath a collar 136 engaging the bottom surface 90 of the head portion 62 of the stud member 30. The collar 136 wraps around the outwardly facing edges of the head portion 62 to support the outwardly extending edges of the seal 72. A printed label 138 is shown sandwiched between the seal 72 and the head portion 62. However, indicia can be printed directly on the seal 72 without departing from the scope of the invention.

Although a collar 136 is shown to provide additional upwardly facing surface area for supporting the label 138, the collar 136 can be omitted and the seal 72 can be secured directly onto the head portion 62 without departing from the scope of the invention.

[0046] In yet another embodiment shown in Fig. 8, a collar 140 engaging the bottom surface 90 of the head portion 62 of the stud member 30 includes a thin walled upper portion 142. The upper edge 144 of the upper portion 142 is crimped over the seal 72 to secure the seal 72 over the head portion 62.

[0047] In another embodiment shown in Fig. 9, angles 20', 22' are provided for use with a conventional meter ring 12' having radially extending flanges 104', 106' with holes 116, 118 defining axes extending tangential to the meter ring 12'. The angles 20', 22' sandwich the flanges 104', 106' therebetween, and orient the housing member 28 and stud member 30 to allow frontal engagement of the stud member 30.

[0048] The second angle 22' includes a first leg 112' and a second leg 114'. The first leg 112' engages an outwardly facing surface of one of the flanges 106', and includes a post 120 extending substantially perpendicular from the first leg 112' through the flange holes 116, 118.

[0049] The first angle 20' includes a first leg 108' and a second leg 110'. The first leg 108' engages an outwardly facing surface of the other flange 104', and includes a hole 122 aligned with the flange holes 116, 118. The angle hole 122 receives the post 120 extending from the second angle 22' to prevent unauthorized removal of the flanges 104', 106' from between the first legs 108', 112' of the angles 20', 22'.

[0050] In another embodiment, shown in Fig. 10, a stud member 30' includes a head portion 162 having a stem 166 that extends into the housing member 28'. The shank portion 60' is joined to the head portion stem 166 by a separable portion 164 received in

the housing member through hole 36'. In this embodiment, the separable portion can be broken using a torque or bending force.

[0051] While there have been shown and described what is at present considered the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications can be made therein without departing from the scope of the invention defined by the appended claims.